PHILIPS

TEST EQUIPMENT
CATALOG FILES

MANUAL

PASSIVE PROBE

PM 9351 - PM 9351L

ATTENUATION 10x
Versions /01 and higher

9499 440 13411

740215/1/01

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1. GENERAL

1.1. INTRODUCTION

The PM 9351 is a 10x attenuator probe, designed for real time oscilloscopes up to 150 MHz, having a BNC input jack and 14 to 21 pF input capacitance, paralleled by 1 MΩ. The PM 9351L is a similar probe with a longer cable (2,5 m instead of 1,5 m).

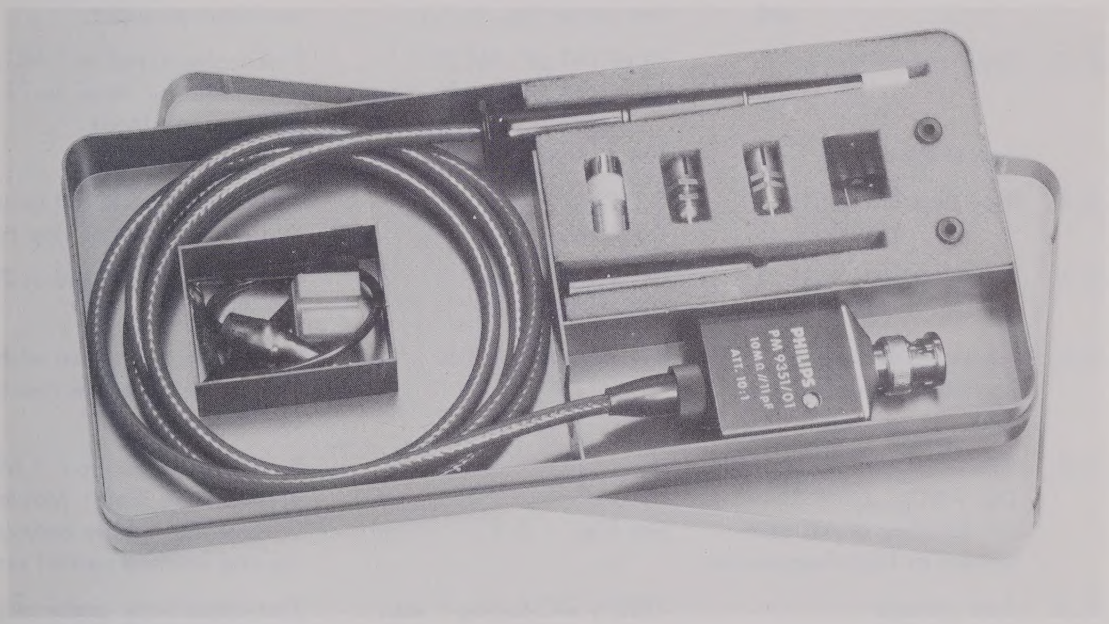


Fig. 1.1.1. Probe set PM 9351

1.2. TECHNICAL DATA

Electrical

	Characteristic		Specified performance	Additional information
1.2.1.	Compensation range		≥ 14 pF up to ≤ 21 pF	Input capacitance of oscilloscope, that can be compensated for
1.2.2.	Attenuation		10x (±2 %)	Probe connected to 1 MΩ oscilloscope input
1.2.3.	Input resistance	DC	10 MΩ (±2 %)	Probe connected to 1 MΩ (±5 %) oscilloscope input
		AC	See curve Fig. 1.2.1.	
1.2.4.	Input capacitance	LF	11 pF (±1 pF) PM 9351 14 pF (±1 pF) PM 9351L	Probe connected to 1 MΩ, paralleled by 14 pF to 21 pF oscilloscope input
	reactance at	HF	See curve Fig. 1.2.1.	
1.2.5.	Rise time PM 9351 PM 9351L		≤ 1,2 ns ≤ 1,6 ns	Probe only; measured between 10 % and 90 % points of step response
1.2.6.	Bandwidth PM 9351 PM 9351L		DC - ≥ 300 MHz DC - ≥ 220 MHz	Probe only; measured at 70 % (-3 dB)
1.2.7.	Aberrations (ringing, rounding, overshoot and tilt)		not exceeding ±3 %	Probe only; measured with 1 ns rise time pulse on a 7 ns rise time oscilloscope
1.2.8.	Maximum allowable voltage DC + AC_{peak} for derating of AC component at high frequencies		±500 V See Fig. 1.2.2.	Probe connected to a 1 MΩ oscilloscope input. Maximum voltage applicable between probe tip and earthed part of probe body
1.2.9.	Test voltage		1500 V DC during 1 sec.	Test conditions: probe output terminated with 1 MΩ. Temperature: 15 °C to 25 °C; rel. humidity: ≤ 80 %; at sea level

Environmental

	Characteristic	Specified performance	Additional information
1.2.10.	Temperature		
	Storage	-40 °C to +70 °C	Test procedure IEC 68 tests Ab and Bb; recovery time from -40 °C to room temperature being 1 hour
	Operating	-25 °C to +70 °C	Test procedure IEC 68 tests Ab and Bb. Within electrical specifications
1.2.11.	Humidity, non-operating	21 cycles of damp heat test; temperature 25 to 40 °C; relative humidity 90 to 100 %; cycle time 24 hours	Test procedure IEC 50 B (CO) 142
1.2.12.	Altitude		
	Operating	to 5 000 m	Within electrical specifications
	Storage	to 15 000 m	

Environmental

Characteristic	Specified performance	Additional information
1.2.13. Vibration, operating	45 minutes each axis; frequency varied 10 Hz - 150 Hz - 10 Hz in ten-minute cycles; constant displacement 0.7 mm p-p from 10 Hz to 60 Hz; constant acceleration 50 m/s^2 ($\approx$5 g) from 60 Hz to 150 Hz. Further 10 minutes each axis at any resonance point. Attachment to vibration platform by means of a BNC connector at one end and a mini connector at the other end	Test procedure IEC 68 test F
1.2.14. Shock, non-operating	Probe stands 1000 bumps each axis of half sine waves with a peak acceleration of 100 m/s^2 ($\approx$10 g) Attachment to shock platform by means of BNC connector at one end and a mini connector at the other end	Test procedure IEC 50 A (CO) 110
1.2.15. Transport		
Package drop	1 m on each corner and each flat surface, 12 drops in total	
Package toppling	10 minutes each axis at a frequency of 7 Hz and an amplitude of 7 mm.	

Mechanical

Characteristic	Specified quantity				Additional information
	L	W	H		
1.2.16. Dimensions					
Probe body	105	20 (max)	-	mm	
Cable	1500	-	-	mm	L = 2500 mm for PM 9351L
Correction box	80	33	17	mm	+ BNC connector
1.2.17. Weight net PM 9351	250 g				Probe in box, including standard accessories
PM 9351L	275 g				

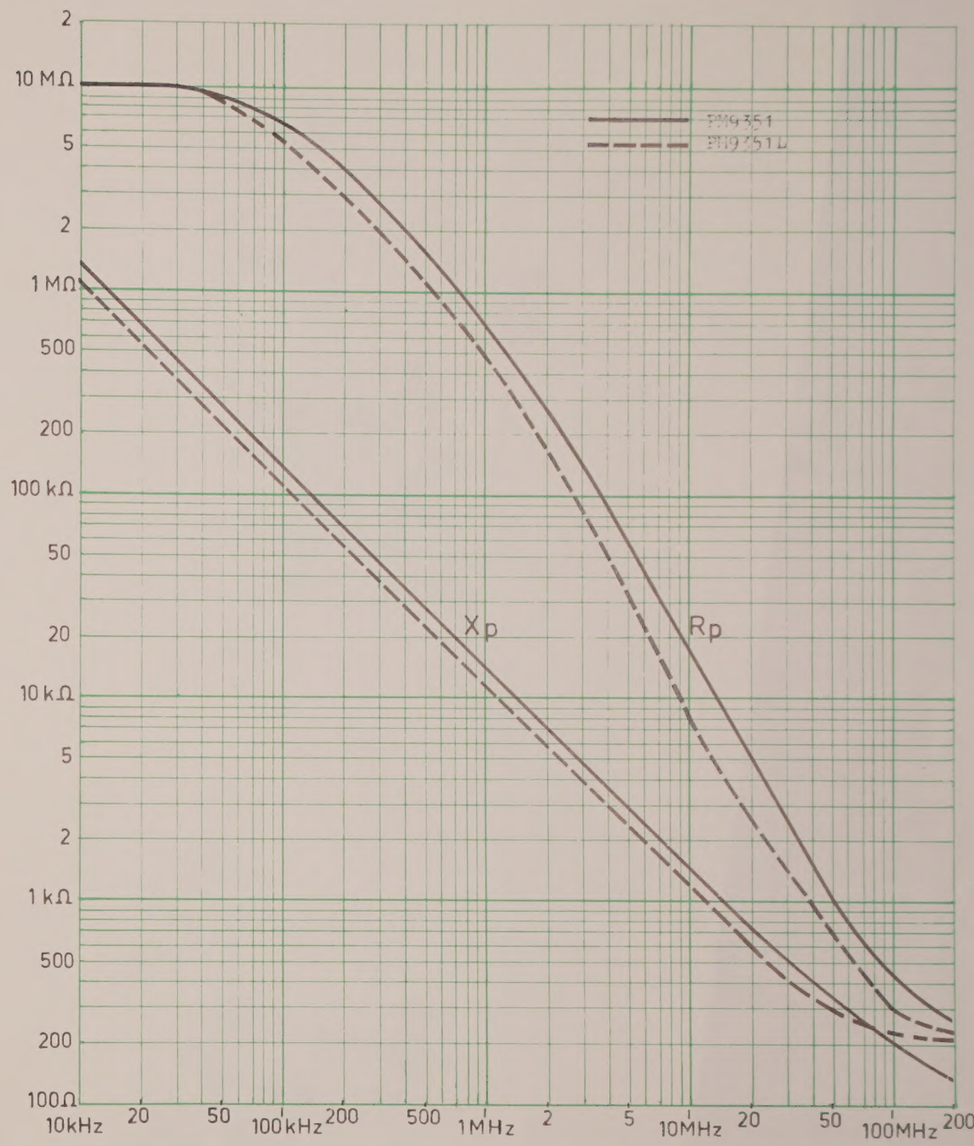


Fig. 1.2.1. Input resistance (R_p) and reactance (X_p) versus frequency MA8337

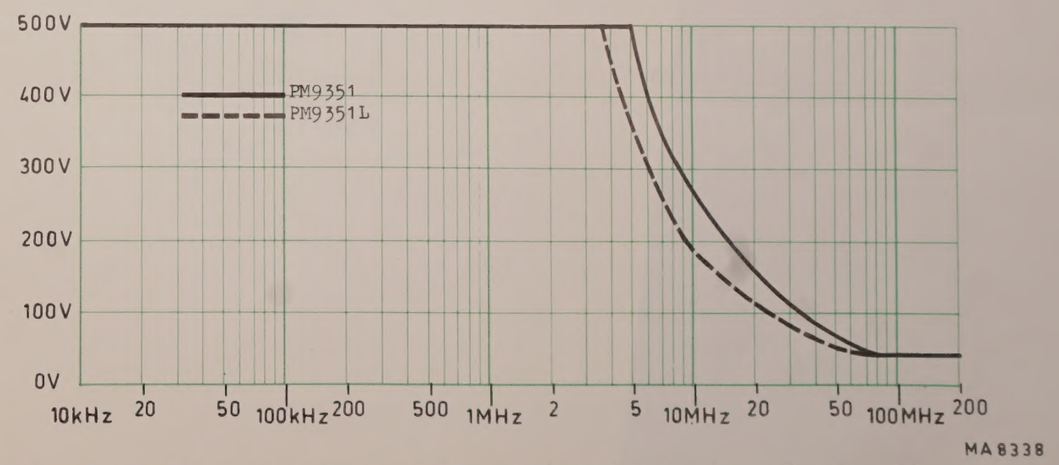


Fig. 1.2.2. Max. a.c. component of input voltage ($\pm V_{peak}$) as a function of frequency

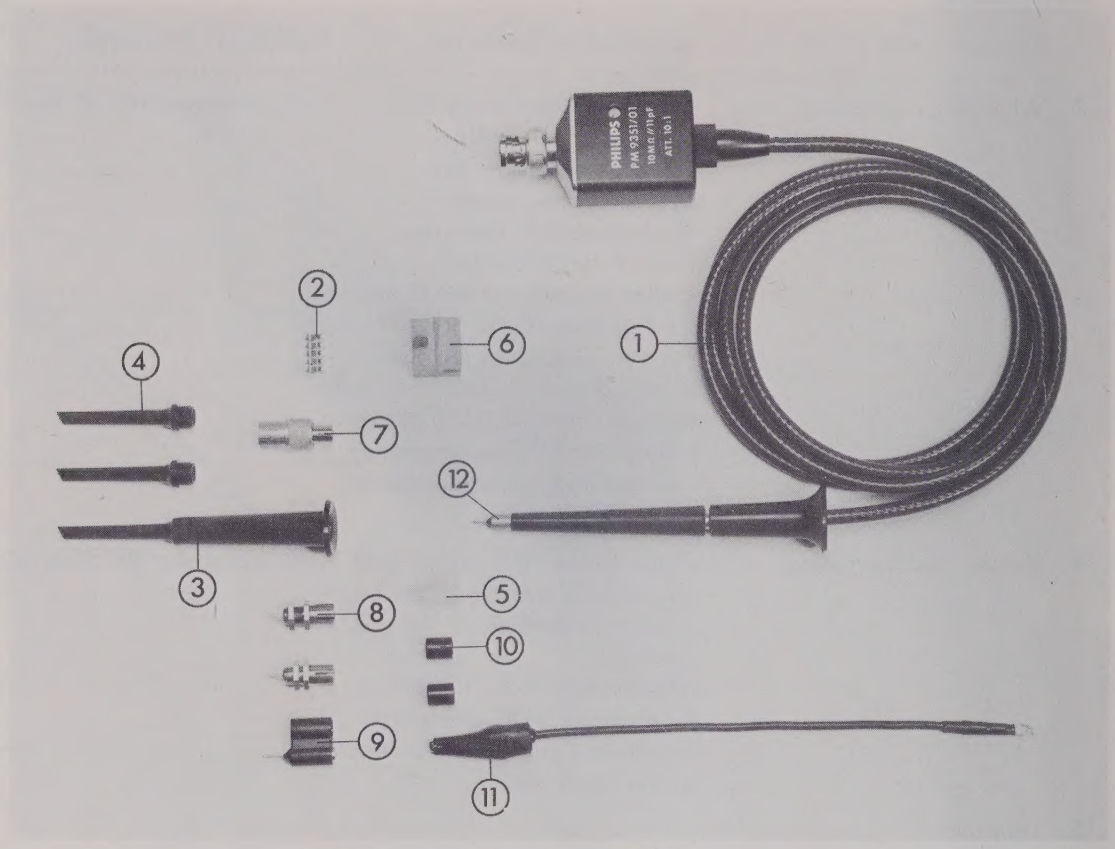


Fig. 1.3.1. Probe with accessories

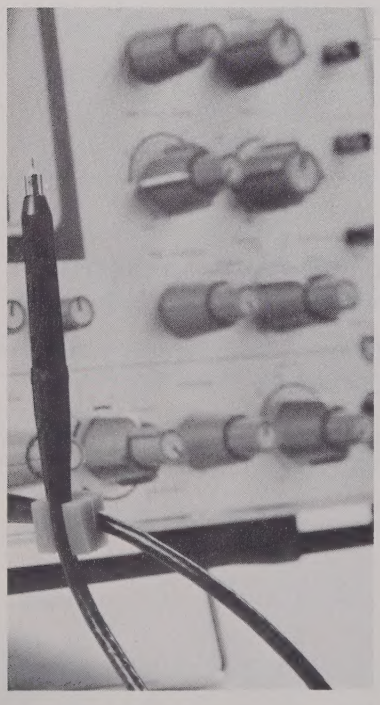


Fig. 1.3.2. Using the probe holder

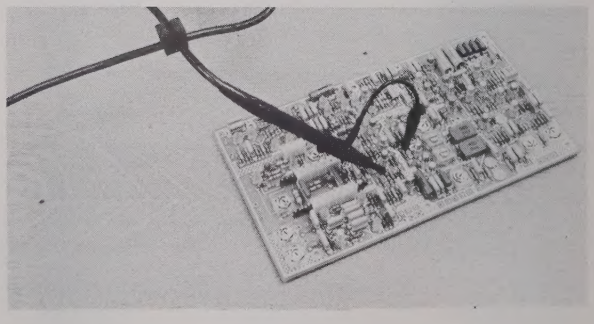


Fig. 1.3.3. Using the probe holder

1.3. ACCESSORIES (Fig. 1.3.1.)

Item 1 Probe, cable and compensation box.

Item 2 Five soldering terminals.
In densely wired circuits the soldering terminals may be incorporated as routine-test points.

Item 3 Test hook.
The test hook is slid over the probe tip; by pushing the probe tip deeper in the test hook, the hook will protrude, so that the test point can be gripped.

Item 4 Two spare test hook sleeves.
These test hook sleeves are supplied with the probe, to serve as replacements for damaged parts. The test hook sleeve is screwed on to the test hook holder.
Insert the wire hook so that the opening is formed by its tip and the longer side of the sleeve.

Item 5 Two protective caps.
If the probe is not in use, one of the protective caps should be fitted in order to prevent damage to the probe pin.

Item 6 Probe holder.
The probe holder is pushed over the probe cable, close to the compensation box. During a break in the measurements, the probe cable (close to the probe body) can be pushed into the vacant slit of the probe holder (Fig. 1.3.2.).
The probe holder can also be used to take the weight off the probe when it is permanently connected to a circuit (Fig. 1.3.3.).

Item 7 BNC/measuring pin adaptor plug.

Item 8 Two miniconnectors.
These miniconnectors may be incorporated into a circuit as routine-test points. Earthing the outer shell of the miniconnectors obviates use of the earthing cord (item 11 in Fig. 1.3.1.).

Item 9 Earthing attachment.
This attachment facilitates signal and earth connections, if the test point is surrounded by an earthed surface.
The spring loaded earthing pin guarantees a good connection even when the test point and earthing point are on different levels.

Item 10 Two insulating caps.
In densely wired circuits, an insulating cap may be slid over the metal part of the probe, to prevent contact between the probe housing and surrounding conductors. The earth connection is made by means of the earthing cord (item 11 in Fig. 1.3.1.).

Item 11 Earthing cord.
The fork of the earthing cord is pushed into the slot in the middle of the probe body. The crocodile clip is connected to the earthing point of the circuit under test.

Item 12 Two probe tips (not shown separately)
These tips are supplied with the probe to serve as replacements for damaged parts (see also section 3.2.4.).

II. OPERATION

The measuring probe has been adjusted and checked by the factory. However, to match the probe to your oscilloscope, the following manipulation is necessary.
Connect the measuring pin to socket CAL of the oscilloscope.
A trimmer (C3) can be adjusted through a hole in the compensation box to obtain optimum square-wave response.

See the following examples Figs. 2.1.1., 2.1.2., 2.1.3.

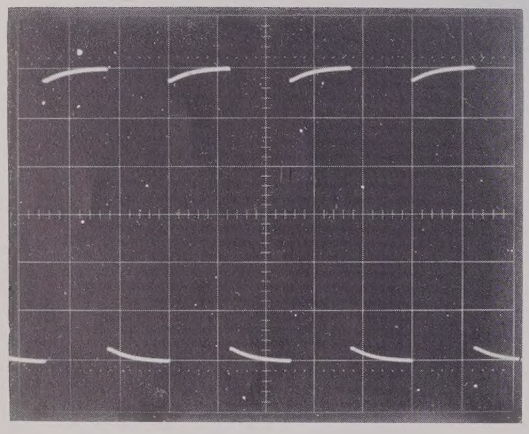


Fig. 2.1.1. C3 overadjusted

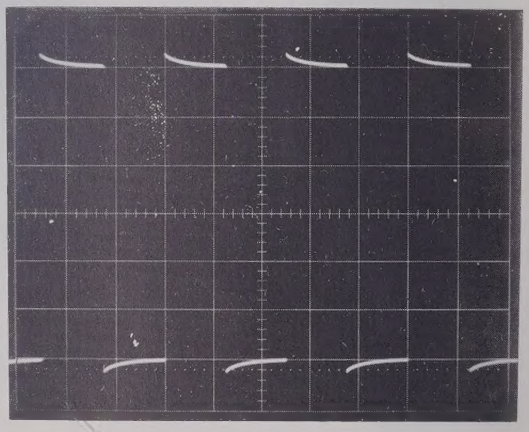


Fig. 2.1.3. C3 underadjusted

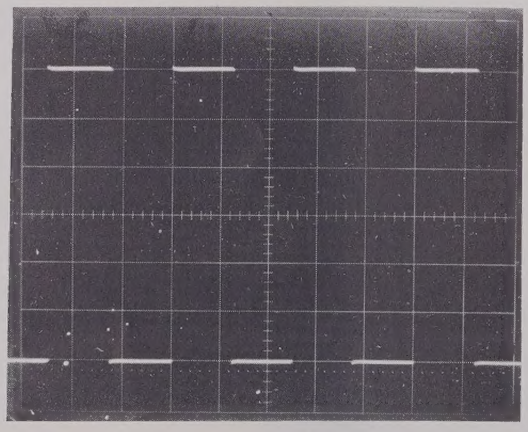


Fig. 2.1.2. C3 correctly adjusted

III. SERVICE DATA

3.1. DISMANTLING

3.1.1. Dismantling the probe

The forward part (13) of the measuring probe can be screwed from the rear part (16). (13) and (14) can then be slid from (15) and (16).
The RC combination (15) is soldered to (16).
For replacement of (15) refer to section 3.2.

3.1.2. Dismantling the compensation box

Unscrew the ribbed collar of the compensation box to the cable and slide it back over the cable. The casing (20) can then also be slid back over the cable. The electrical components on the printed wiring board are now accessible at both sides.

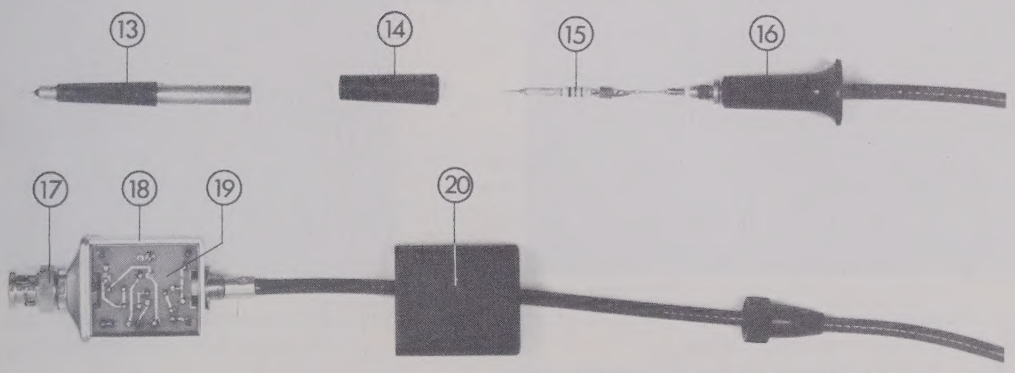


Fig. 3.1.1. Assembly of the probe PM 9351

3.2. REPLACING PARTS

3.2.1. Assembling the measuring probe

When assembling the measuring probe, the RC assembly must be at dead centre in the probe tip (Fig. 3.2.1.).
Ensure that the correct distance between the top of plug (A) and the frontside of the earthing ring (B) is maintained. The distance AB must be $62^{-0.5}$ mm (see Fig. 3.2.1.).

3.2.2. Replacing the cable assembly

Dismantle the compensation box as described in section 3.1.2.
Unsolder the connection between inner conductor and printed circuit board.
Keep the lining of the compensation box steady and loosen the nut with a 8 mm spanner.
Replace the cable and fit it, working in the reverse order.

3.2.3. Replacing the BNC connector

Dismantle the compensation box as described in section 3.1.2.
Unsolder the connection to the printed circuit board.
Keep the lining of the compensation box steady and loosen the BNC connector with a 3/8 in spanner.
Replace the BNC connector and fit it, working in the reverse order.

3.2.4. Replacing the probe tip

The damaged tip can either be pulled out by means of a pair of pliers or be pushed out by means of a rod. A new tip must be firmly pushed in.

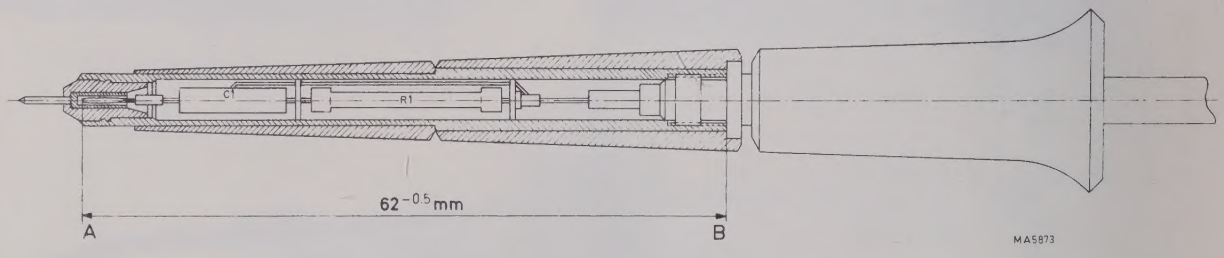
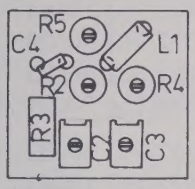


Fig. 3.2.1. Fitting of the RC-combination

3.3. ADJUSTMENT OF THE H.F. STEP RESPONSE

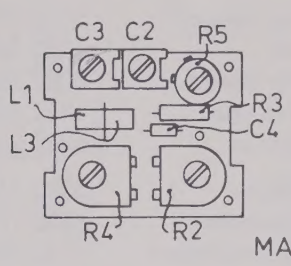
The h.f. step-response correction network has been adjusted by the manufacturer to match an average oscilloscope input. For optimum pulse response, however, the probe can be adjusted to match your particular oscilloscope. Later readjustment is only necessary if the probe is to be used with a different type of oscilloscope, or after replacement of an electrical component. Therefore, proceed as follows:
Connect the probe to a fast-pulse generator (rise time $\leq$ 1 ns) which is terminated by its characteristic impedance. Dismantle the compensation box as described in section 3.1.2.
Set the generator to 100 kHz. Adjust C2, R2 and R4 alternatively to obtain a display as shown in Fig. 3.3.3.
It is important that the leading edge is as steep, and the top is as flat, as possible.
Incorrect setting of R2 and R3 give rise to pulse distortions as shown in Fig. 3.3.2. and Fig. 3.3.4.

PM 9351/01
PM 9351L/01



MA 8492

PM 9351/02
PM 9351L/02



MA 8491

Fig. 3.3.1. Printed wiring boards with adjusting elements

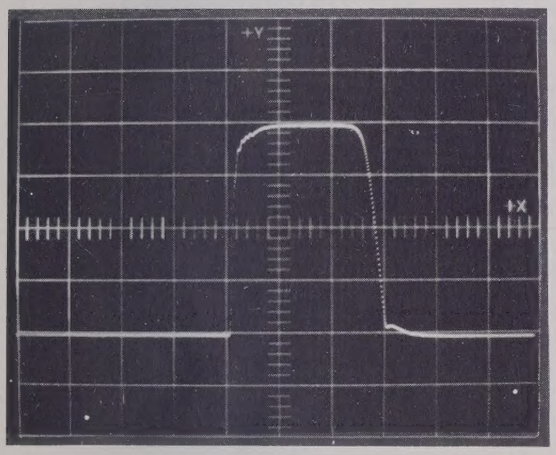


Fig. 3.3.2. Rounding due to incorrectly set potentiometers and capacitor

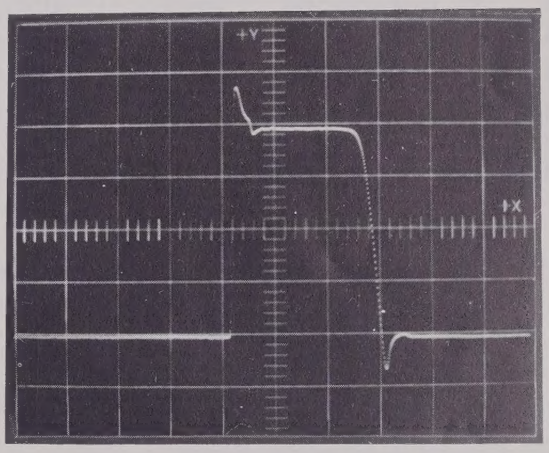


Fig. 3.3.4. Overshoot due to incorrectly set potentiometers and capacitor

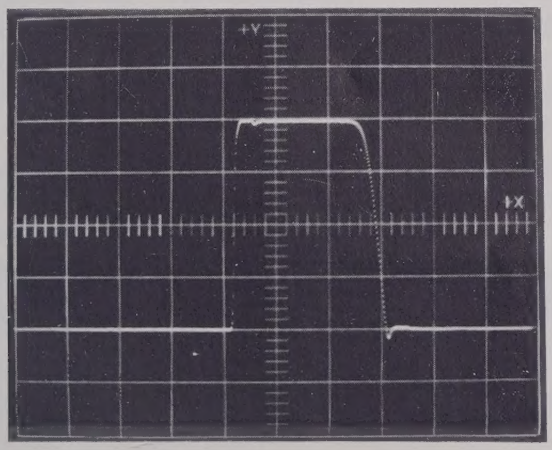


Fig. 3.3.3. Preset potentiometers and capacitor correctly adjusted

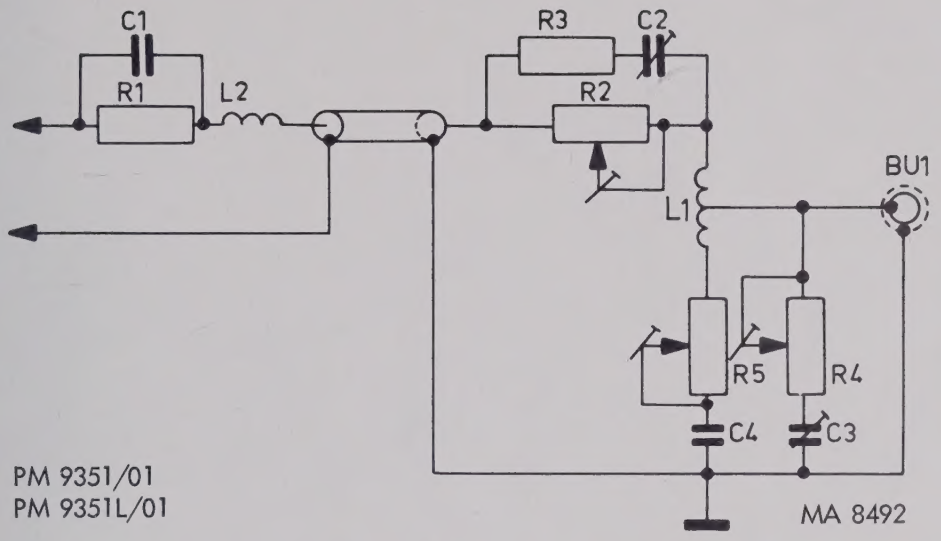
3.4. LIST OF MECHANICAL PARTS (Figs. 1.3.1. & 3.1.1.)

Item	Description	Order number PM 9351/01	PM 9351L/01	PM 9351/02	PM 9351L/02
2	Soldering terminal	5322 255 40026	5322 255 40026	5322 255 40026	5322 255 40026
3	Test hook	5322 264 20024	5322 264 20024	5322 264 20024	5322 264 20024
4	Test hook sleeve	5322 264 20028	5322 264 20028	5322 264 20028	5322 264 20028
5	Protective cap	5322 532 60535	5322 532 60535	5322 532 60535	5322 532 60535
6	Probe holder	5322 256 94034	5322 256 94034	5322 256 94034	5322 256 94034
7	BNC adapter	5322 263 50022	5322 263 50022	5322 263 50022	5322 263 50022
8	Mini-connector	5322 267 10043	5322 267 10043	5322 267 10043	5322 267 10043
9	Earthing attachment	5322 264 20023	5322 264 20023	5322 264 20023	5322 264 20023
10	Insulating cap	5322 462 70726	5322 462 70726	5322 462 70726	5322 462 70726
11	Earthing cord	5322 321 20223	5322 321 20223	5322 321 20223	5322 321 20223
12	Probe tip	5322 268 14017	5322 268 14017	5322 268 14017	5322 268 14017
13	Probe shell	5322 264 20025	5322 264 20025	5322 264 20025	5322 264 20025
14	Sleeve	5322 532 70126	5322 532 70126	5322 532 70126	5322 532 70126
15	RC Assembly	5322 219 80181	5322 219 84019	5322 219 80181	5322 219 84019
16	Cable assembly	5322 320 14004	5322 320 14013	5322 320 14004	5322 320 14013
17	BNC connector	5322 264 10025	5322 264 10025	5322 264 10025	5322 264 10025
18	Frame	5322 447 64001	5322 447 64001	5322 447 64001	5322 447 64001
19	Print unit complete	5322 216 54054	5322 216 54054*)	5322 216 54092	5322 216 54092*)
20	Casing	5322 447 64002	5322 447 64002	5322 447 64012	5322 447 64012
21	Box with insert	5322 600 34003	5322 600 34003	5322 600 34003	5322 600 34003

*) This printed-wiring board is a standard replacement. Therefore, C4 must be replaced by a 4,7 pF capacitor and R3 by a 110 Ohm resistor (see 3.5. LIST OF ELECTRICAL PARTS).

3.5. LIST OF ELECTRICAL PARTS

Item	Description	Order number PM 9351/01	PM 9351L/01	PM 9351/02	PM 9351L/02
C2	Trimmer 10 pF 300 V	5322 125 50049	5322 125 50049	5322 125 50049	5322 125 50049
C3	Trimmer 18 pF 300 V	5322 125 50051	5322 125 50051	5322 125 50051	5322 125 50051
C4	Ceramic 10 pF (normal) 4,7 pF (L) 500 V	4822 122 31195	4822 122 31189	4822 122 31195	4822 122 31189
L1	Coil	5322 157 50682	5322 157 50682	5322 157 44003	5322 157 44003
L2	Frroxcube bead	4822 526 10025	4822 526 10025	5322 526 10025	5322 526 10025
L3	Coil	-	-	5322 157 44003	5322 157 44003
R2	Potentiometer 1 kOhm	5322 100 10043	5322 100 10043	5322 100 10112	5322 100 10112
R3	Metal film MR25 249 Ohm (110 Ohm in L)	5322 116 54499	5322 116 54474	5322 116 54499	5322 116 54474
R4	Potentiometer 2 kOhm (01) or 2,2 kOhm (02)	5322 100 10144	5322 100 10144	5322 101 14008	5322 101 14008
R5	Potentiometer 500 Ohm (01) or 470 Ohm (02)	5322 100 10135	5322 100 10135	5322 103 14039	5322 103 14039



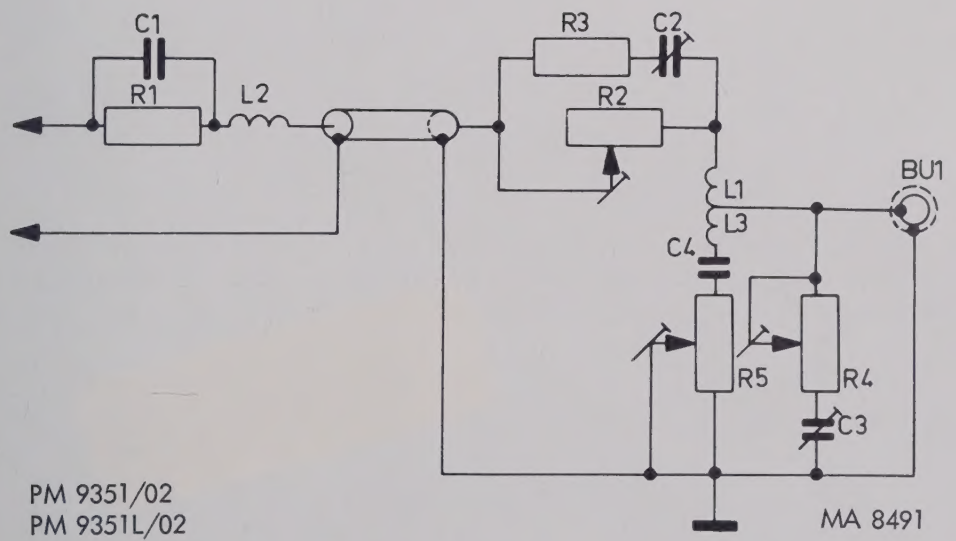
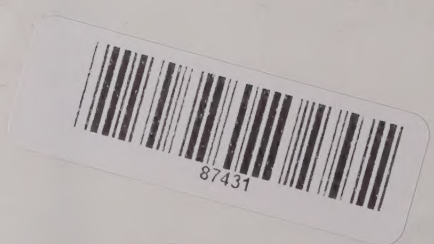


Fig. 3.5.1. Circuit diagrams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